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Touch screen technology adoption and utilisation by educators in early childhood educational institutions: A review of the literature

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Abstract

The adoption of information and communication technology (ICT) in early childhood educational settings, in particular touch screen technology such as interactive whiteboards and tablet computing devices has potential for use within early childhood educational institutions. We conducted a literature review in order to understand what literature currently exists in this research area. The nature of ICT implementation as a dynamic, complex process, and concepts of organisational innovation were considered when examining articles. We demonstrate that there is a significant gap in the body of knowledge in regards to touch screen technology in early childhood, particularly from a process perspective, and suggest that further research is required to understand the interplay between individual actions and organisational structural influences. This will contribute to the development of an understanding that can support the successful implementation of touch screen technology within early childhood educational institutions.

Keywords

Interactive whiteboards, tablets, adoption, early childhood, educators.

INTRODUCTION

This article is concerned with answering the question: what literature currently exists on the adoption and utilisation of touch screen technology by educators in early childhood educational institutions? There are worldwide variations in what the constitutes the term ‘early childhood’ and its institutions (Bolstad 2004); however, for the purposes of this article, we define ‘early childhood educational institutions’ as those establishments that provide educational services to children from three to five years of age, prior to the formal compulsory years of schooling. These institutions are known by different names around the world, including ‘nursery’, ‘kindergarten’, ‘prep’, ‘pre-k’, and ‘pre-school’. We decided to focus our study exclusively on institutional early childhood education, excluding the adoption and utilisation of touch screen technology at home-based early childhood settings.

The adoption of information and communication technology (ICT) in early childhood educational settings is of international interest. ICT in education is promoted by the United Nations Educational Scientific and Cultural Organisation as a way of addressing ‘access, inclusion and quality’ and the ‘digital divide’ (UNESCO 2011). This is being attended to by many countries as they move to integrate ICT-specific guidelines in the various national education frameworks which influence early childhood educational institutions. They include the new Australian Early Years Learning Framework (Australian Government DEEWR 2009), Te Whãriki, the curriculum framework for the early childhood educational sector in New Zealand (New Zealand Ministry of Education 1996), the United States’ National Association for the Education of Young Children ‘Technology and Interactive Media as Tools in Early Childhood Programs’ policy statement (NAEYC 2012), and the United Kingdom’s Early Years Foundation Stage (United Kingdom Department for Education 2012). In addition to this, there are additional forces driving the push for ICT to be included in early childhood educational settings, including: the recognition of a need to skill young children in technology-driven ‘new media literacies’ (Alper

2013); the acknowledgement that ICT already has an effect on the people and environments that surround young children's learning and therefore it is timely for it to be critically examined within the early childhood education sector (Bolstad 2004); and that it provides the potential to meet the needs and enhance learning opportunities for the current generation of young children, known as 'digital natives' (Prensky 2001) or 'generation alpha' (McCrindle 2011).

From the variety of ICT available to educators, devices that employ touch screen technology in particular are viewed by educators to have potential for use within early years settings, due in some part to the removal of barriers to the use of technology that exist for use with young children with using a traditional keyboard and/or mouse, which requires a certain level of physical and motor skill development to use, along with the level of cognitive development required to use the device (Terreni 2010).

By examining what literature currently exists on the adoption and utilisation of touch screen technology by educators in early childhood educational institutions, with reference to existing literature findings from other educational institutions, we will highlight the research gap that exists and suggest further research directions.

TOUCH SCREEN TECHNOLOGY

Personal computers, now considered to be widespread in educational institutions such as schools and universities (Kirkup and Kirkwood 2005; Zhao and Frank 2003), use what is commonly referred to as a WIMP (Windows, Icons, Mouse, and Pull-down menus) user interface. User input is provided via a keyboard and mouse or trackpad/trackball device for devices such as laptops and netbooks. In recent years there has been a change in the paradigm of computing device user interfaces, in particular how users provide input to these devices. This new form of interaction is known as a gestural, or 'natural' interface (Norman and Nielsen 2010) and involves the user providing input to the device by using their fingers to create single and multiple touch gestures on the screen. This form of user interface is relatively new, and in educational settings its use has been typified by technology such as tablet computing devices, herein known simply as 'tablets' (Goodwin 2012), and interactive whiteboards (Higgins et al. 2007). McManis et al. (2010) believe that touchscreen technology is becoming the dominant 'learning vehicle' in schools, with early childhood educational institutions now steadily making the transition as well (p.6).

Interactive whiteboards are large touch-sensitive display screens that are similar in size and appearance of a normal whiteboard. The screen is connected to a data projector and computing device and the user interacts with the board by touching it or using a pointing device. Interactive whiteboards were originally developed for use in corporate office situations but found use initially within universities in the mid 1990s (Murphy et al. 1995) before being introduced to schools in the late 1990s-early 2000s (Higgins et al. 2007).

Tablets are small, thin portable computing devices with a single touch-sensitive screen. Tablets were not solely developed for an educational market, but have become popular within educational institutions due to their perceived technological and pedagogical benefits (Goodwin 2012). Although tablets have been adopted in educational institutions previously (e.g. Anderson et al. 2006; El-Gayar and Moran 2007), their popularity has increased since the arrival of Apple's iPad in 2010, which was the first of what Clark and Luckin (2013) call 'Post-PC' tablet devices. These devices are distinguished from the earlier generation of stylus-based resistive touch screen tablets by the following characteristics: an operating system developed specifically for the mobile device; a capacitive high-resolution touch screen; a multi-touch finger driven user interface; the concept of software 'apps', which are smaller software applications that are specially designed to run on the mobile device and are accessible to purchase through marketplace-style functionality; and a much broader range of connectivity options, including wireless broadband and 3G and 4G mobile networking.

Authors such as Kennewell and Morgan (2003), Romeo et al. (2003), Vincent (2007), Terreni (2010), Parnell and Bartlett (2012) and Beschorner and Hutchison (2013) have noted the particular suitability of touch screen technology for early childhood educational settings, and according to a 2012 survey by the United States Early Childhood Technology Collaborative, 55% of educators of children aged two to 12 reported using interactive whiteboards, 34% used tablet devices such as iPads and 5% used multi-touch tables/surfaces (Lepi 2013).

TOUCH SCREEN TECHNOLOGY ADOPTION AND UTILISATION – MORE THAN JUST A LIST OF FACTORS

The adoption and utilisation of touch screen technology in early childhood educational institutions can be viewed as stages in the ICT implementation process, which Kwon and Zmud (1987) define as "an organisational effort to diffuse an appropriate information technology within a user community" (p.231). The majority of research conducted to better understand both ICT implementation problems and how they can be resolved can

be categorised into five streams (Kwon and Zmud 1987 p.228): factors research, mutual understanding research, process research, political research and prescriptive research.

According to Kwon and Zmud, the factors research stream, which focuses on individual, organisational and technological forces which are important to ICT implementation success (Cooper and Zmud 1990), represents the largest research stream in the literature (Kwon and Zmud 1987 p.228). Factor research studies are invariably defined in terms of use or satisfaction with such use, and are often quantitative. However Kwon and Zmud propose viewing implementation from a broader perspective, integrating the research streams and drawing from organisational change, innovation and technology diffusion literature to propose a broader perspective of ICT implementation, represented as a six stage process, as illustrated below:

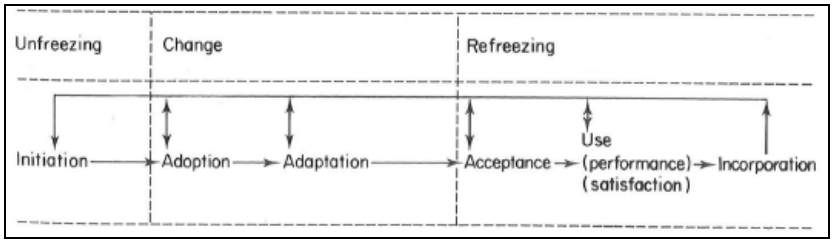

Figure 1: Kwon and Zmud's (1987) six-phase view of the implementation process

Kwon and Zmud designed this model by taking into consideration Lewin's (1952 cited in Kwon and Zmud 1987) change model, and incorporating the three-stages from the common view (Pierce and Delbecq 1977 cited in Hameed et al. 2012; Rogers 2003; Tornatzky et al. 1990) of organisational innovation: initiation, adoption and implementation. However they recognise the limitations of the three stage model, and in producing the new model incorporated four assessments (acceptance, usage, performance and satisfaction) which can be used to evaluate IT implementation success as well as providing feedback loops, thus addressing the shortcomings of the three-stage model which they note "focuses on facilitating innovation…[and] excludes any post-adoption or post-innovation evaluation process" (p.232).

In regards to the context of ICT implementation in educational institutions, Straub's (2009) article discussed four main adoption and diffusion theories as determined by their prevalence of appearance in the existing education body of literature. These were Rogers' (2003) Diffusion of Innovation Theory, Hall and Hord's (1987) Concerns-Based Adoption Model (CBAM), Davis' (1989) Technology Acceptance Model (TAM) and Venkatesh et al.'s (2003) Unified Theory of Technology Adoption and Use (UTAUT). Two of these theories can be thought of as process-oriented. Rogers, whose work is comprised of a number of separate frameworks/models which can be utilised to understand individual adoption, has a sequential stage-based framework for understanding innovation in an organisation (p.421). According to Straub (2009), Hall and Hord's Concerns-Based Adoption Model was developed to address the need for an adoption model specific to an academic environment, rather than one used in a corporate setting. The CBAM provides a developmental perspective on how an educator's individual concerns influence the integration of an innovation, addressing "affective and cognitive concerns of teachers…[to] ease the change process" (p.633). In contrast, both TAM and UTAUT are concerned with providing quantifiable factors for explaining individual acceptance of a technology.

Each of the four theories outlined in the above paragraph examine adoption at an individual level; however, adoption also has to be studied at a group and organisational level (King 1990 cited in Hameed et al. 2012). Other theories regarding innovation adoption that consider the organisational and/or group level include the multi-level framework for organisational innovation adoption proposed by Frambach and Schillewaert (2002), and the Technology-Organisation-Environment framework (TOE) by Tornatzky et al. (1990). Complimenting this understanding of different levels of adoption, Slappendel (1996) proposed a framework of perspectives on examining organisational innovation, distinguishing between an individualist, a structuralist and an interactive process perspective. The individualist perspective views individuals as the main source of change, with their characteristics as the centre of interest; the structuralist perspective, which examines organisational characteristics; and the interactive process perspective, which views the adoption as an dynamic, continuous change over time, where there is interaction between the various individual and organisational factors. As Kautz and Nielsen (2004) note, "the actions of innovative individuals cannot be divorced neither from the activities of other individuals nor from the organisational structures within which they operate" (p.6).

METHODOLOGY

The literature review about touch screen technology adoption and utilisation by educators in early childhood educational institutions was conducted for a larger body of work, of which an abridgment is presented in this paper, was guided by the findings and recommendations by Webster and Watson (2002).

As this paper is concerned with the adoption and utilisation of touch screen technology by educators in early childhood educational institutions, the initial keywords determined for the search were 'adoption', 'utilisation', 'touch screen technology', and 'early childhood'. These keywords were then further expanded to include the specific touch screen technology device terms of 'tablet' and 'interactive whiteboard'. Alternative keywords were also included to maximise the scope of the searches. Brand names were included as the touch screen technologies under examination are often referred to by specific brand names due to their popularity (e.g. SMART board branded interactive whiteboards manufactured by SMART Technologies; Apple's iPad tablet computer). As the nomenclature for the institutions providing educational services prior to the formal compulsory years of schooling differs around the world (which we defined earlier in this paper as 'early childhood educational institutions'), additional keywords were added.

After testing the keywords in trial searches, we found that using the keywords 'adoption' and 'utilisation' were found to prohibitively limit the number of articles returned and they were subsequently discarded. The final set of keywords were: 'interactive whiteboard', 'electronic whiteboard', 'SMART board', 'tablet', 'iPad', 'early childhood', 'pre-school', 'kindergarten', 'nursery', 'prep', and 'pre-K'. In order to learn from the literature which currently exists on touch screen technology in other educational institutions such as schools and universities, a separate search was performed with the following set of keywords: 'interactive whiteboard', 'electronic whiteboard', 'SMART board', 'tablet', 'iPad', 'school', 'K-12', 'university', 'higher education', and 'tertiary'. Again, alternative keywords were included to maximise the scope of the searches; the term 'K-12' indicating the years of compulsory schooling from kindergarten to year 12, in addition to the nomenclature for university or post-compulsory education. Searches were conducted to find the keywords in article titles and/or abstracts.

A number of journal databases were utilised to find articles examining the adoption and utilisation of touch screen technology by educators in early childhood institutions. As the nature of the study combines both the fields of IS and education, it was important to search journals of both disciplines: IS journal articles (from journals including the Association for Information Systems' Senior Scholars 'basket of 8' and highly ranked journals according to the Australian Council of Professors and Heads of Information Systems) were obtained by searching ProQuest Central; and articles in education journals were sourced through EBSCOhost (Education Complete, ERIC). The Scopus database was also used to find relevant articles from both disciplines.

RESULTS

After conducting the keyword searches, the abstracts of the resultant articles were scanned by the main author to identify appropriate articles. The scanning revealed that although a significant number of articles exist related to touch screen technology within university and school educational sectors, there are a limited number of articles available related to touch screen technology within the early childhood sector. We found a total of 350 articles on interactive whiteboards within university and school sectors, but only 12 within the early childhood sector. In regards to tablets, 875 articles were situated within the university and school sectors, and only 24 within the early childhood sector. The articles reviewed, while not proclaimed to be a definitive list, are representative of the existing body of work. The findings from the review of these articles will be elaborated on in the subsequent sections.

Adoption and utilisation of touch screen technology by educators in early childhood educational institutions

The literature that exists which studies the adoption and utilisation of touch screen technology by educators in early childhood educational institutions is limited. Despite examination of the resultant 36 articles for interactive whiteboards and tablets in early childhood educational institutions, no articles were found which examined the implementation of the technology from a process perspective, nor in regards to stages of the implementation process other than the 'use' stage. These findings go some way to confirming Siraj-Blatchford and Siraj-Blatchford's (2003 cited in Terreni 2010 p.91) findings that systematic research studies in early childhood educational settings are "virtually non-existent".

According to Tu and Kuo (2012), ICT in early childhood educational institutions has received less attention in the body of literature, and McManis and Gunnewig (2012) state that research on newer technologies and applications have yet to catch up with their availability to young children (p.15). Terreni (2010) in particular notes that there is "very little research or literature about the use of interactive whiteboards in early childhood settings" (p.91). Vincent (2007) concurs with the lack of research for interactive whiteboards in early childhood educational institutions. Nevertheless, we found a handful of descriptive case studies of how educators are using the technology with young children. Lisenbee (2009) conducted her doctoral study on teacher's use of an interactive whiteboard during storytelling and although the study focuses on the students, she does discuss

implications for the teacher and proposes a model that teachers can use to teach the children to use the technology. Morgan (2010) investigated the teaching of children aged three to seven years of age in UK classrooms fitted with interactive whiteboards. The findings revealed that the teachers valued the ability of the interactive whiteboard to promote playful and interactive experiences for student learning, but that in practice, their use in this way was limited. McManis et al. (2010) focused on the relationship between the use of an interactive whiteboard and the development of school readiness skills, but concentrated mainly on evaluating the contribution to the children's literacy and numeracy skill achievement rather than the teachers; they simply described how teachers received training when the interactive whiteboards were installed and had a 'booster' training session prior to the study, and what literacy and numeracy activities where taught by the teachers using the interactive whiteboard (p.7-8). In their discussion, McManis et al. noted that to meet the goal of using technology to support school readiness, "successful integration into the early childhood education program's curriculum and daily practices around developmentally appropriate content" is required, (p.14) but no elaboration is provided on how this can be achieved.

In regards to tablets, similar findings emerged, with a few descriptive studies of how educators are using the technology with young children in early childhood educational institutions. Couse and Chen (2010) explored the viability of tablet computers in early childhood, focusing on the children, their behaviours and achievements. However in a small section of the article they consider teacher perception of the children's interest and viability of the tablet as a tool in early childhood, finding that they were positive towards to use of such technology and about the potential benefits provided. Similarly, Geist (2012) study focused on children's use of the iPad in an early childhood classroom, with a small mention towards the end of the article that the teachers reporting that they were 'stunned' at the children's ability and independence with the iPads and that using them on projects created a much 'richer' experience (p.33). Most recently, Beschorner and Hutchison (2013) conducted a qualitative case study which described the use of iPads in two preschool classrooms of four and five year old children to facilitate emergent literacy. The authors note that the teachers were not familiar with the iPad, or any other tablet device prior to the study, but they were "willing, even excited to integrate the iPad into their instruction" (p.23). Interestingly an article by Parnell and Bartlett (2012) did not focus on the children as the other studies had, but rather on how early childhood educators can use tablets (and smartphones) in a more administrative role, as a means of documenting students' daily progress and integrating it into online portfolios. Benefits to this form of usage included saving valuable planning time, and giving families a window into their children's learning, thus making the technology a powerful for strengthening the child's home-school relationship (p.51).

Adoption and utilisation of touch screen technology by educators in school and university educational institutions

Because a paucity of literature exists which examines touch screen technology adoption and utilisation by educators in early childhood educational institutions, we examined what literature exists in the neighbouring fields of other educational institutions – namely schools and universities. We contend that examining the literature on touch screen technology in schools and universities can assist in providing an understanding which can guide future research on touch screen technology within early childhood educational institutions.

We found that the majority of the articles came from journals and conferences which have an educational focus. Many of the interactive whiteboard articles came from journals such as Computers and Education, Learning Media and Technology, and The Australasian Journal of Educational Technology and the majority of the tablet articles originated from the American Society for Engineering Education (ASEE) Conference proceedings. Highly ranked IS journals and conferences are poorly represented in these search results, highlighted by the existence of two AMCIS articles (Arnett et al. 2005; Chen et al. 2008), two HICSS articles (Henderson and Yeow 2012; Tootell et al. 2013) and one ACIS article (Al-Qirim 2012). Three of these articles are in regards to tablets and one on adoption and usage of interactive whiteboards. This could perhaps indicate that interdisciplinary research combining the fields of IS and educational institutions in regards to touch screen technology adoption and utilisation is lacking. Discussion of these articles is included in the following sections.

Interactive whiteboards

A number of literature reviews already exist for interactive whiteboards in educational settings (Glover et al. 2005; Smith et al. 2005) with the most recent one by Higgins et al. (2007). Higgins et al. split the literature into 3 categories (p.213): first, the potential of the technology as identified in the literature about the initial adoption of the technology in educational settings; second, the pedagogical impact of interactive whiteboards on both teachers and pupils; and third, the empirical evidence relating to learning and achievement. Focusing on the first category of articles about the initial adoption, the majority of articles were found to be descriptive in nature, often discussing the benefits obtained from the adoption of the interactive whiteboards. These benefits espoused

included enthusiasm and positive attitudes towards the technology by both students (BECTA 2003; Al-Qirim 2011) and teachers (Kennewell and Morgan 2003; Smith et al. 2005); increased student engagement and interest through the provision of multimedia/multi-modal learning and interactivity (Levy 2002). The literature revealed that teachers found the interactive whiteboards particularly helpful in teaching science due to the teacher's ability to present interactive simulations and virtual experiments which helped students to better visualise the topic (Akbas and Pektas 2011); languages due to the capacity to provide multimedia-based activities for memorisation of vocabulary (Schmid 2006); and for supporting students with disabilities and special needs (Wall et al. 2005). Some disadvantages or problems were identified, mainly practical and logistical, such as the cost (Lacina 2009), visual problems such as positioning in the classroom (Levy 2002) and the need for appropriate in-service training and professional development (Couse and Chen 2010).

Although no articles were found which examined the implementation of interactive whiteboards as a whole process, two studies were found to examine educator acceptance of interactive whiteboards within university and school settings, which can be considered a stage of the process. Saltan et al. (2010) undertook a quantitative survey of 34 Turkish primary school teachers and used TAM to find that teachers had a positive attitude towards the interactive whiteboard and found it relatively easy to use and useful, but noted that despite these positives 69 percent of the participants considered using interactive whiteboards was often frustrating (p.2363). Al-Qirim's work (2011; 2012), which included an ACIS 2012 paper, investigated the university teaching faculty and instructors, and used a custom framework based on Rogers' innovation adoption factors of relative advantage, complexity and compatibility in addition with factors previously identified from the literature (p.2).

Tablets

Little is known about 'Post-PC' tablets in educational settings, as the iPad and other 'Post-PC' tablets have only been available since 2010, therefore it will take some time for empirical studies on their adoption and implementation to be published. Geist (2011) comments that although some literature is beginning to appear, it consists mainly of descriptions of pilot studies and opinion articles.

In order to try to gauge what literature is emerging on tablets, particularly 'Post-PC' tablets, two articles have notably attempted to address this issue.

Within university educational settings Murphy (2011) reviewed publicly available material to identify worldwide trends in iPad and adoption and use. He categorised the findings into six typologies of use: ubiquitous access to course and subject materials; enrolment and administration; peer-to-peer and peer-to-educator collaboration; content generation; research/material yielding; and productivity enhancement. Literature on 36 universities identified as having adopted the iPad found that it was overwhelmingly used as a content delivery tool, and noted that there appeared to be a relationship between university size and the adoption of the device, with many smaller US universities exploring the potential of the technology (p.27). It was also noted that to obtain full benefit from such technology, a "fundamental reconfiguration of teaching delivery methods, curriculum design, staff attitudes and skills as well as the obvious IT/IS infrastructure and resources such as a significant upgrade of wireless broadband provision is required" (Garaj 2010 cited in Murphy 2011 p.29).

With regards to school educational settings, Clark and Luckin (2013) recently released an article titled 'What the research says: iPads in the Classroom' which reviewed the literature, including newspaper reports and online blog postings in addition to academic and corporate research articles. The authors examined earlier tablet computing studies (such as Becta 2005, Luckin 2010, QCA 2003-4 cited in Clark and Luckin 2013) to identify transferrable lessons before examining the current literature on 'Post-PC' tablet devices. They categorised their findings into three categories: research about teaching and learning with iPads; research about the implications for decision makers; and research about the implications for different user groups (technical support, teachers, parents and learners). Teacher usage of the iPads included data management such as tracking student registration and data, and for supporting assessment, feedback and personal reflection (Burke 2012, Heinrich 2012, Winsolow et al. 2012 all cited in Clark and Luckin 2013). Numerous benefits were cited, including the technology's ability to motivate and engage, enhance learning and transform teaching practice, and make communication between teachers and students, and school and home easier. Clark and Luckin also determined that there were multiple drivers and implementation models for iPad adoption: most often 1:1 implementations were driven by government bodies and school leaders, whereas shared group/class set implementations originated from industry pilots, individual teachers or 'digital champions'. Based on the articles by Burden et al. 2012, BESA 2012, Clarke 2012, and Heinrich 2012 all cited in Clark and Luckin 2013) the authors suggested three important phases in integrating tablets into school: pre-implementation phase; initial roll out; and end of phase review. Also noted is the requirement for careful, long term planning before, during and after the event, consideration of existing technical networks, technical support implications, ownership models, the technology lifecycle, and broad stakeholder preparation and on-going engagement (p.3).

In addition to Clark and Luckin's review of the literature, two other articles are worth mentioning due to their broader perspective in not just describing benefits and uses of tablets. Crichton et al.'s (2012) article on the deployment of iPod Touch and iPad devices in a Canadian school district discussed the use of the technology by students and teachers but additionally discussed practicalities such as the physical infrastructure required to support the devices (e.g. establishing a computer configured for multiple user access to a single iTunes instance) and the establishment of a digital commons through which the devices are synced, powered, maintained and managed (p.27). The authors also noted that "the institutional, public deployment and support for iDevices is significantly different from traditional computer lab requirements and even wireless laptop configurations within classrooms and across schools" (p.27). In regards to participant behaviour and attitudes, they found that the lack of familiarity with the devices was unanticipated, contrary to the prior expectation that many participants would have owner similar devices and would be already proficient in their use (p.1). However the authors found that the devices were well-received and well-used. Henderson and Yeow's (2012) case study on iPad adoption in a primary school (presented at HICSS 2012) also discussed both uses in the classroom, benefits, and additionally noted the importance of management and facilitation, in particular having a good management framework in place in order to realise the iPad's potential (p.87).

As with the findings on interactive whiteboards, no articles were found which examined the process of the technology implementation as a whole. However four studies were found to examine individual educator acceptance of tablets within university and school settings, which represents one stage of the technology implementation process. Anderson et al. (2006) and Toto et al. (2008) utilised the UTAUT and TAM models respectively. Anderson et al. examined faculty staff acceptance at a College of Business at a university, and in addition to validating the model (with findings "consistent with previous studies" p.437), found that the Performance Expectancy construct was the most important variable in user acceptance noting that "if faculty believe that a technology will be of use to them, they will use it" (p.436). Toto et al. studied university engineering faculty staff over two years in two phases. They found significant differences between the results from each phase: phase 1 participants seemed to be more open, willing and ready to use the technology, and found the tablets to be more useful and easier to use; phase 2 participants seemed less willing to learn and participate, were less confident and appeared to require more support (p.11). The authors also described how they witnessed a community of practice develop over the course of study (p.8). Within school settings, Gasparini and Culen (2012) used TAM to consider perceived ease of use and usefulness during a one year pilot study of iPads in an elementary school classroom. In their findings they noted that the teacher in the study had found little interest from colleagues and school leadership, but that combining the research results with "good and sustainable ways to support the teachers in adopting the new technology" could positively influence acceptance (p.144). UTAUT was chosen by Ifenthaler and Schweinbenz (2013) to address the "limited research [that] has been conducted on the acceptance of technological innovations amongst teachers" (p.525). The aim of the study was to identify factors influencing teachers' acceptance of tablets in a school environment. Although the authors selected UTAUT as their research model, they used it in a qualitative manner, rather than the usual quantitative way, to "complement research on the acceptance of technology through a more detailed qualitative examination of the topic" (p.526). They found that there was significant diversity in not only the attitude of the teachers towards the technology, but also in regards to the performance expectancy and facilitating conditions (p.532).

Although these studies shed light on which factors contribute to the educator's individual acceptance of the technology, it only provides us with a small section of understanding related specifically to individual acceptance, which is only part of the ICT implementation process as a whole and only one perspective on examining innovation adoption and implementation.

CONCLUSION

As Bolstad (2004) has identified, ICT already affects the people and environments that surround young children's learning and it offers new opportunities to strengthen many aspects of early childhood education practice. Although there is support for the development and integration of ICT into education policy, curriculum, and practice across the early childhood educational space (Bolstad 2004; NAEYC 2012), according to Tu and Kuo (2012), ICT in early childhood educational institutions has received less attention in the body of literature, and this paper has confirmed findings such as those by McManis and Gunnewig (2012) that state that research on newer technologies and applications have yet to catch up with their availability to young children. This study concurs with findings by Wood et al. (2008) and Plowman and Stephen (2003) that a gap in the research exists in regards to ICT in early childhood educational institutions.

Furthermore, we cannot simply apply the findings from other educational institutions such as schools and universities because there are differences between those educational institutions and early childhood educational institutions; for example the importance of parental and family involvement and engagement (Marcon 1999), the

nature of the curriculum, which tends to be child-led and emergent with no formal prescriptive curriculum (Australian Government DEEWR 2009), the specific educational needs and complexities of educating young children including school readiness (Emig 2000), and early childhood educational institutions varying in funding sources, structure purpose and delivery which all differ world-wide (Kamerman 2000).

Despite an understanding that technology adoption and implementation is not a simple event, but rather a complex, developmental change process (Cooper and Zmud 1990; Kwon and Zmud 1987; Straub 2009), the majority of research on touch screen technology in educational institutions appears to fall into two particular phases of Kwon and Zmud's six phase process: 'acceptance'; and 'use'. The articles related to educator acceptance of interactive whiteboards and tablets can be classified as falling into the area that Kwon and Zmud define as the 'factors research stream'; there is a risk that research into touch screen technology may continue to contribute to "long, almost exhaustive, list of factors that may affect the uses of technology" (Zhao and Frank 2003 p.809-810) without constructing a full understanding the adoption and implementation process. The articles categorised as Kwon and Zmud's 'use' phase consist of descriptive case studies which although provide information on how educators are currently using the technology, do not provide any information on the process itself. As Kwon and Zmud (1987) stress, understanding the implementation process itself is as important for implementation success as the technology itself. Reflecting on Slappendel's (1996) perspectives of individualist, structuralist and interactive process perspectives on innovation adoption in organisations, we can conclude that the much of the existing literature falls into the 'individualist' realm. This may be problematic, as Kautz and Nielsen (2004) note in their study of software process improvement innovation in an organisation, "neither the individualist nor the structural perspectives alone provide a deep understanding of the innovation implementation process" (p.20). Therefore although the literature has provided us with a limited understanding of the implementation of touch screen technology in educational institutions from an individualist perspective, and has begun to touch on areas regarding organisational considerations, there is a gap in the research on understanding the interplay between individual action and organisation structural influences, and need for understanding this through an interactive process perspective. The paucity of literature in the early childhood sector on touch screen technology has been revealed, and further research will utilise this review to inform the creation of a comprehensive and holistic framework which employs individualist, structuralist and interactive process perspectives that will be tested and modified based on the empirical findings of the research.

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